present, and that they are retreating not so much through cosmic or telluric causes as through meteorological changes depending partly on the prolonged action of man on the earth.—On the molecular velocities of gaseous bodies (continued), by Arnoldo Violi.—Experimental studies on Thapsia resin, by Francesco Canzoneri.—Distribution of the spots, faculæ, eruptions, and protuberances on the surface of the sun, deduced from the observations made at the Observatory of the Collegio Romano during the year 1882, by Pietro Tacchini.—Official return of the archæological discoveries made at Este, Bologna, Rome, Bolsena, Albano, and some other parts of Italy during the November of 1883, by S. Barnabei.—Meteorological observations made at the Observatory of the Campidoglio during the month of November, 1883.

January 6, 1884.—Notice of Prof. Carlo De Stefani's work on the "Lower Lias Formation of the Northern Alps," by S. Taramelli.—New determination of the optical characters of Christianite (anorthite) and Phillipsite (variegated copper ore), by Alfredo des Cloizeaux.—Note on the existence of two distinct optical axes in the Gismondine crystals (two illustrations), by the same author.—On the temperature corresponding to the Glacial period (continued), by Pietro Blaserna.—Some observations of the eighth satellite of Saturn, by E. Millosevich.—Meteorological observations made at the Observatory of the Campidoglio during the month of December, 1883.

Revue d'Anthropologie de Paris, No. 1, 1884, contains: Concluding part of Dr. P. Broca's "Description des Circonvolutions Cérébrales de l'Homme d'après le Cerveau Schématique," completed by Dr. Pozzi. The latter writer draws special attention to the third frontal circonvolution in man, which was first definitely shown by Broca to be the seat of the organ of speech. This function, in thirteen out of fourteen cases, is associated with the left frontal, and in one out of fourteen with the right frontal, as has been proved by loss of the faculty of speech, known as "aphasia," or, according to the writer, more correctly as "aphemia," which is due to lesions of that portion of the brain. Dr. Pozzi suggests that, in deference to the scientific importance of Broca's discovery, this special convolution should henceforth be distinguished by his name.—The continuation of M. Mathias Duval's lectures on "Le Transformisme," in which the writer treats specially of heredity and natural selection, drawing his materials, as in the earlier parts, almost exclusively from English sources.—"Les Cafres et plus spécialement les Zoulous," by Elie Reclus. This is the first of a series of papers intended by the author to elucidate the history of primitive peoples.

Rivista Scientifico-Industriale, Florence, December 15–31, 1883.—Account of the economic earthquake-warners constructed by the brothers Brassart of the Roman Central Meteorological Bureau (two illustrations), by E. Brassart.—De Tromelin's new aperiodical galvanometer.—On the electric resistance of porcelain, sulphur, and some other non-conducting substances.—On the measurement of electromotor forces.—On the determination of the work executed and absorbed by a dynamo.—Contribution to palæontological studies in Southern Italy, by Michele del Lupo.

Rendiconti del R. Istituto Lombardo, Milan, January 10, 1884.—On numbers irreducible by complex numbers (concluded), by Prof. C. Formenti.—Contribution to the physiology of the enteric juice, by Prof. L. Solera.—Clinical demonstration of a lymphatic infiltration of mechanical origin in the cornea; preliminary notice, by Dr. R. Rampoldi.—On the declaration of bankruptcy at the instance of the creditors, in the new Italian Commercial Code, by L. Gallavresi.—Attenuating and aggravating circumstances in the Criminal Code (concluded), by Prof. A. Buccellati.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 21.—"On an Explanation of Hall's Phenomenon." By Shelford Bidwell, M.A., LL.B.

Mr. E. H. Hall's papers, giving a full account of his well-known discovery, are printed in the *Philosophical Magazine* for March 1880, November 1880, September 1881, and May 1883. His original experiment was as follows:—A strip of gold leaf was cemented to a plate of glass and placed between the poles of an electromagnet, the plane of the glass being perpendicular to the magnetic lines of force. The current derived from a Bunsen cell was passed longitudinally through the gold, and, before the electromagnet was excited, two equipotential points were found by trial near opposite edges of the gold leaf, and about midway between the ends: when these points were connected with a galvanometer there was of course no deflection. A current from a powerful battery being passed through the coils of the magnet, it was found that a galvanometer deflection occurred, indicating a difference of potential between the two points, the direction of the current across the gold leaf being opposite to that in which the gold leaf itself would have moved across the lines of force had it been free to do so. On reversing the polarity of the magnet the direction of the transverse electromotive force was reversed; and when the magnet was demagnetised the two points reverted to their original equipotential condition.

Subsequent experiments showed that the direction of the effect differed according to the metal used. Thus with silver, tin, copper, brass, platinum, nickel, aluminium, and magnesium, the direction of the transverse electromotive force was found to be the same as in the case of gold: with iron, cobalt, and zinc the direction was reversed, and with lead there was no sensible effect in either direction.

Hall's results may be expressed by saying that the equipotential lines across the strip are rotated in a definite direction with respect to the lines of force. This effect was attributed by him to the direct action of the magnet on the current; and very great importance has been attached to the phenomenon in consequence of the opinion expressed by Prof. Rowland and others that it is connected with the magnetic rotation of the plane of polarisation of light, and thus furnishes additional evidence of an intimate relation between light and electricity.

A number of experiments made by the author convinced him, however, that no direct action of the kind supposed was ever produced, and he ultimately found that Hall's phenomenon might be completely explained by the joint action of mechanical strain and certain thermo-electric effects.

The strain is produced by electro-magnetic action. It will be convenient to refer to the metallic plate or strip (which for the purposes of this explanation may be assumed to be rectangular) as if it were an ordinary map, the two shorter sides being called respectively west and east, and the two longer north and south. Let the south pole of an electro-magnet be supposed to be beneath the strip, and let the strip be traversed by a current passing through it in a direction from west to east. Then the strip will tend to move across the lines of force in the direction from south to north. Since, however, it is not free to move bodily from its position, it will be strained, and the nature of the strain will be somewhat similar to that undergone by a horizontal beam of wood which is rigidly fixed at its two ends and supports a weight at the middle. Imagine the strip to be divided into two equal parts by a straight line joining the middle points of the west and east sides. Then in the upper or northern division the middle district will be stretched and the eastern and western districts will be compressed, while in the lower division the middle part will be compressed and the two ends will be stretched. If now a current is passing through the plate from west to east, the portion of the current which traverses the northern division will cross first from a district which is compressed to one which is stretched, and then from a district which is stretched to one which is compressed; while in the southern division the converse will be the case. And here the thermo-electric effects above referred to come into play.

Sir Wm. Thomson, in 1856, announced the fact that if a stretched copper wire is connected with an unstretched wire of the same material, and the junction heated, a thermo-electric current will flow from the stretched to the unstretched wire through the hot junction, while if the wires are of iron, the direction of the current is from unstretched to stretched. From this it might be inferred that a current would flow through the heated junction from an unstretched or free copper wire to a longitudinally compressed copper wire, and from a longitudinally compressed iron wire to a free iron wire; and experiment shows this to be the case. *A fortiori* therefore the direction of the current through the heated junction will be from stretched to compressed in the case of copper wire, and from compressed to stretched in the case of iron. If therefore a current is passed from a stretched portion of a wire to a compressed portion, heat will (according to the laws of the Peltier effect) be absorbed at the junction if the metal is copper and will be developed at the

junction if the metal is iron. In passing from compressed to stretched portions the converse effects will occur.

It follows from the above considerations that if the metal plate (which is acted upon by a force from south to north and is traversed by a current from west to east) be of copper, heat will be developed in the western half of the northern division and absorbed in the eastern half; while heat will be absorbed in the western half of the southern division and developed in the eastern half. But the resistance of a metal increases with its temperature. The resistance of the north-western and south-eastern districts of the plate will therefore be greater, and that of the north-eastern and south-western districts smaller than before it was strained; and an equipotential line through the centre of the plate, which would originally have been parallel to the west and east sides, will now be inclined to them, being apparently rotated in a counter-clockwise direction.

If the plate were of iron instead of copper, the Peltier effects would clearly be reversed, and the equipotential line would be rotated in the opposite direction.

The peculiar thermo-electric effects of copper, and iron discovered by Thomson are thus seen to be sufficient to account for Hall's phenomenon in the case of those metals. It became exceedingly interesting to ascertain whether the above explanation admitted of general application, and the author therefore proceeded to repeat Thomson's experiments upon all the metals mentioned by Hall. The results are given in the following table, where those metals which in Hall's experiments behave like gold are distinguished as negative, and those which behave like iron as positive :—

Metals	Forms used	Direction of current	Hall's effect
Copper	Wire and foil	S to U [1]	Negative
Iron	Wire and sheet; annealed	U to S	Positive
Brass	Wire, commercial	S to U	Negative
Zinc	Wire and foil	U to S	Positive
Nickel	Wire	S to U	Negative
Platinum	Wire and foil	S to U	Negative
Gold	Foil, purity 99·9 per cent.	S to U	Negative
	Wire, commercially pure	*U to S*	
	Jeweller's 18 carat wire and sheet	S to U	
	Jeweller's 15 carat sheet	S to U	
Silver	Wire and foil	S to U	Negative
Aluminium	*Wire and foil, pure*	*U to S*	*Negative?*
Cobalt	Rod: 8 mm. diameter	U to S	Positive
Magnesium	Ribbon	S to U	Negative
Tin	Foil	S to U	Negative
Lead	Foil (assay)	No current	Nil

[1] S means stretched; U means unstretched.

It will be seen that in every case, excepting that of aluminium and one out of five specimens of gold there is perfect correspondence between the direction of the thermo-electric current and the sign of Hall's effect. With regard to the aluminium, a piece of the foil was mounted on glass, and Hall's experiment performed with it. As was anticipated, the sign of the "rotational coefficient" was found to be positive like that of iron, zinc, and cobalt. Either, therefore, Mr. Hall fell into some error, or the aluminium with which he worked differed in some respect from that used by the author. The anomalous specimen of gold, being in the form of wire, could not be submitted to the same test. It probably contained some disturbing impurity.

It is submitted that the considerations and experiments above detailed render it abundantly evident that the phenomenon described by Mr. Hall involves no new law of nature, but is merely a consequence of certain thermo-electric effects which had been observed nearly thirty years ago.

"Some Relations of Chemical Corrosion to Voltaic Current." By G. Gore, F.R.S., LL.D.

The author states that the chief object of this research was to ascertain the amounts of voltaic current produced by the chemical corrosion of known weights of various metals in different liquids, and to throw some light upon the conditions which determine the entire conversion of potential molecular energy into external (*i. e.* available) electric current. The metals used were magnesium, zinc, cadmium, tin, lead, aluminium, iron, nickel, copper, and silver; some of them being also used in an amalgamated state. The liquids employed were solutions of nitric, hydrofluoric, hydrochloric, sulphuric, fluosilicic, and acetic acids; and potassic hydrate and cyanide, also of different degrees of strength.

The chief numerical results are given in a series of ten tables, a table for each metal. Each table contains the electromotive of the current, the loss and rate of loss of the corroded metal, and of a comparison sheet not producing a current; and the percentage of current obtained in ninety-seven different cases.

The results show that the proportion of loss of the positive plate by "local action" to that by corrosion producing external current varied greatly in different cases, viz. from 1·3 to 95·25 per cent. In no case was the whole of the metal dissolved by "local action," nor did the whole of the corrosion produce external current. In about 6 per cent. of the cases the comparison plate was more corroded than the one which was used to produce a current. Whilst also the contact of a negative metal with the corroding plate usually increased the total corrosion, it commonly decreased the corrosion due to "local action."

The proportion of corrosion attended by external current to that due to "local action," varied with the kind of metal and of liquid; with cadmium it averaged 75·63, and with copper 30·33 percent. of the total corrosion; with solution of potassic cyanide it averaged 63·27, and with dilute nitric acid 31·14 per cent. It varied also with other conditions; and the kind of metal had more influence than that of the liquid. Amalgamation of the metal also had distinct effects upon the proportion, but opposite in different cases. The rate of total corrosion of the positive plate appeared to be related to the degree of electromotive force of the current. The chief cause of the great variation in the proportion of corrosion by "local action" to that producing external current was probably a variation of electric conduction resistance.

March 6.—"Magnetic Polarity and Neutrality." By Prof. D. E. Hughes, F.R.S.

The author, citing the researches of Page, Marianini, Wertheim, Joule, Wiedemann, De la Rive, Weber, Beetz, and Maxwell, together with his own published researches, demonstrating that the molecules of magnetic bodies, such as iron, have inherent polarity, and that all the known effects of magnetism can be explained by the demonstrable rotation of the molecules whenever a change of polarity occurs, now gives a new series of experiments verified by several independent methods, in which he shows that the penetration of the apparent polarity diminishes rapidly from the exterior to the interior of a bar, due to the frictional resistance of its molecules. In rotation, as when the rod or bar is vibrated whilst under the exciting influence, the penetration is four times greater than previously. In all cases, however, there is no reversal of polarity in the interior whilst under the influence of its exciting cause. The instant this is withdrawn neutrality takes place in soft iron, or a partial return to the same state even in the hardest of steel.

The author has discovered that this neutrality is not caused by a mixing of the fluids as assumed by Coulomb, or a heterogeneous arrangement of the molecules as assumed by Ampère and all other theories up to the present time, but that a reaction takes place between the outside or strongest polarity with that of the weaker inside, completely reversing it to a remarkable extent.

A bar of iron under the influence of its exciting cause may be represented by three series of letters, the centre representing the inside of a bar, thus—

N N N
S S S

, but when this influence is withdrawn we should have—

N S N
S N S

. And if the inner reversed polarity exactly balanced the exterior the sum of both would be zero, and consequent neutrality.

The paper describes the methods employed, and gives diagrams of these curves. In certain cases the exterior becomes reversed, as shown by magnetising a soft strip of steel half a millimetre thick, and then reducing it to a nearly perfect neutral state, either by mechanical vibrations, or by heating the strip to red heat. That the outside is reversed is shown by dissolving the exterior in dilute nitric acid, when its previous polarity reappears.

The author cites several methods by means of which an apparent neutrality is shown to be the result of internal reaction, and that in all cases, even in the most permanent magnet, there is a portion of it reversed to its apparent polarity.

The author shows the importance of the knowledge of this fact in the construction of electro-magnets, whenever we desire to have the maximum of effect whilst under the influence of a current with a minimum of remaining magnetism when the influence ceases.

This is shown by experiments upon bars of similar length but of different thickness, solid bars having far greater effect than tubular ones. Experiments were made on electro-deposited iron of varying thickness, showing the remarkable retentive power of extremely thin coatings of soft iron.

The result is given of a series of researches not yet completed (the details of which will be published in a future paper) upon the saturating point of soft iron and steel. The author has found that the atmosphere as well as all gaseous matter has precisely a similar curve of magnetic rise from neutrality to its magnetic saturation, and that bismuth as well as all so-called diamagnetic bodies obey the same law of saturation. Consequently he assumes that all matter is strongly magnetic, the widest limit yet found, from bismuth to soft Swedish iron, being only forty times greater for the iron.

An explanation is given of the well-known disappearance of magnetism at yellow red heat, in which the author assumes, from observed effects of violent mechanical vibrations, that this disappearance is due to a violent molecular oscillation destroying its symmetrical arrangement of polarity.

The author concludes by saying, "Whatever theory we adopt as an explanation of evident magnetism, it will be found that neutrality occurring after the cessation of an external inducing force upon a bar of iron or steel is the result of symmetrically opposed polar forces, producing apparent waves of opposite polarity, or reactions between the exterior and interior of a bar of iron."

Linnean Society, March 6.—Sir J. Lubbock, Bart., president, in the chair.—Dr. A. B. Shepherd and Mr. Jas. Dallas were elected Fellows, and Mr. W. Hodgson an Associate of the Society.—The President announced the receipt of an intimation from the Foreign Office (through the Science and Art Department) of an International Ornithological Congress to be held in Vienna in the beginning of April.—Mr. J. Britten exhibited specimens of *Lithospermum purpureo-cæruleum*, illustrating points in the life-history of the plant as described by Mr. J. W. White in the *Journal of Botany*.—Mr. F. O. Bower drew attention to a figure published in the *Gardener's Chronicle* representing a case of proliferation of the so-called "double needle" of *Sciadopitys verticillata*. He alluded to the various views as to the morphological value of the "double needle," and concluded that the one first propounded by Prof. A. Dickson, afterwards discussed adversely by Von Mohl, but favourably by Goebel, appears most in accordance with the history of its development.—Dr. M. Masters showed and made remarks on an example of bud variation of *Pinus silvestris*.—There was exhibited for Mr. T. E. Gunn a stuffed specimen of a male variety of the common moorhen (*Gallinula chloropus*), shot near Norwich last spring.—Mr. A. W. Bennett drew attention to specimens under the microscope of species of *Ptilota* and *Callithamnion* which demonstrated the continuity of the protoplasm.—Prof. Cobbold gave a verbal account of a communication from Dr. P. Manson of Hong Kong, in which the author furnishes fresh evidence as to the *rôle* of the mosquito considered as the intermediary host of *Filaria sanguinis-hominis*. Dr. Manson has verified his previous observations in the most complete manner, and he now recognises and describes six well-marked stages of the Filariæ whilst they are dwelling within the body of the insect. In the discussion following, Dr. T. R. Lewis confirmed Manson's statements in many particulars.—The Secretary read an abstract of a paper on the Indian species of *Cyperus*, with remarks on some others that specially illustrate the subdivisions of the genus. The author divides this memoir into three sections: (1) a descriptive account of each part of a *Cyperus*, viz. the culm, inflorescence, &c., comparing these successively in all the Indian species; (2) contains a discussion of some difficult species and disputed genera; (3) is a systematic arrangement with descriptions of the Indian species, with short citations of some non-Indian species that more particularly illustrate the subdivisions and groups.—Prof. St. G. Mivart read a paper on the relations between instinct and other vital processes. In this he contended that instinct cannot be divided by a very hard and fast line from such vital processes as reflex action, processes of repair after injuries, and the process of development of the individual; and that these latter were more readily explained as activities especially instinctive, than that instinct could be explained by reflex action or by lapsed intelligence. The vital processes referred to were also shown to have an important bearing on the question of the origin of species.—Then followed a paper, notes on Afghanistan algæ, by Dr. J. Schaarschmidt, founded on material derived from Surgeon-Major Aitchison's collection of plants made during the Afghanistan Expedition in 1880.

Zoological Society, March 4.—E. W. H. Holdsworth, F.Z.S., in the chair.—Mr. Howard Saunders, F.Z.S., exhibited and made remarks on specimens of two Gulls (*Xema sabini* and *Larus philadelphia*) in the breeding-plumage, both killed in Scotland. Mr. Saunders also made some observations upon the specimen of *Larus atricilla* in the British Museum, said to be the one killed by Montagu at Winchelsea, and came to the conclusion that the bird in question was not Montagu's specimen. Mr. Saunders likewise exhibited a specimen of *Puffinus griseus* killed off the Yorkshire coast.—A letter was read from Dr. Ch. W. Lütken, Foreign Member, calling attention to a specimen of an Echidna in the Zoological Museum of Copenhagen, which seemed to be different from the ordinary *Tachyglossus aculeatus*, and which Dr. Lütken was of opinion might possibly be referable to the lately-described *T. lawesi* of New Guinea.—Mr. J. E. Harting, F.Z.S., exhibited and made observations on some antlers of roe deer from Dorsetshire and Scotland.—Mr. W. R. Ogilvie Grant read a paper on the fishes of the genera *Sicydium* and *Lentipes* (belonging to the family Gobiidæ), in which an attempt was made to arrange the species of *Sicydium* into smaller groups, the members of which were found to be allied together by convenient and distinctive characters. Five new species of *Sicydium* were described.—A communication was read from Mr. F. Moore, F.Z.S., on some new Asiatic Diurnal Lepidoptera, chiefly from specimens in the Calcutta Museum.—A communication was read from the Count T. Salvadori, C.M.Z.S., containing some critical remarks on an African Duck, *Anas capensis*, Gmelin.

Chemical Society, March 6.—Dr. W. H. Perkin, president, in the chair.—It was announced that a ballot for the election of Fellows would take place at the next meeting (March 20).—The following papers were read:—Studies on sulphonic acids, No. i.; on the hydrolysis of sulphonic acids, and on the recovery of benzenes from their sulphonic acids, by Drs. H. E. Armstrong and A. K. Miller. By passing steam through a solution of the sulphonic acids or the sulponates in their own weight of sulphuric acid, the authors find that all the benzenes can be recovered. No decomposition of any of the benzenes tried takes place, and an almost theoretical yield is obtained. The method has been of great value in separating the hydrocarbons obtained from camphor.—On a relation between the critical temperature of bodies and their thermal expansions as liquids, by T. E. Thorpe and A. W. Rücker. By combining the simple expression recently published by Mendeléeff for the expansion of liquids with some of the conclusions arrived at by Van der Waals, the authors arrive at the result that the density of a liquid is very nearly proportional to the number obtained by subtracting its absolute temperature from twice its absolute critical temperature.—Remarks on the densities of members of homologous series, by Dr. W. H. Perkin. The author has plotted curves in the usual way, taking the number of carbon atoms as abscissæ, and a scale of numbers embracing those of the densities at 20° C. as ordinates. The bodies examined consisted chiefly of very carefully purified acids and ethers of the fatty series. It is obvious from the curves that the densities of the homologous acids and ethers follow a regular law.—Note on some experiments made at the Munster Agricultural School to determine the value of ensilage as a milk- and butter-producing food. Cows were fed on ensilage for a week and on mixed food for a week, and the author has analysed the milk and weighed the butter produced. The results in the two experiments are almost identical, so that ensilage is not inferior to ordinary food.—Note on the behaviour of the nitrogen of coal during destructive distillation and a comparison of the amount of nitrogen left in cokes of various origin, by Watson Smith.—On a hitherto unnoticed constituent of tobacco, by T. J. Savery. The author, having noticed in tobacco a substance which strongly reduced Fehling's solution, investigated the subject, and separated a body closely resembling

caffetannic acid, and which he proposes to call tabacotannic acid.

Geological Society, February 20.—Prof. T. G. Bonney, F.R.S., president, in the chair.—Thomas Lionel Bates, G. J. Williams, and Alfred Prentice Young were elected Fellows of the Society.—The following communications were read :—On a recent exposure of the shelly patches in the Boulder-clay at Bridlington, by G. W. Lamplugh, communicated by Dr. J. Gwyn Jeffreys, F.R.S.—On the so-called *Spongia paradoxica*, S. Woodward, from the Red and White Chalk of Hunstanton, by Prof. T. McKenny Hughes, F.G.S.—Further notes on rock-fragments from the South of Scotland embedded in the low-level Boulder-clay of Lancashire, by T. Mellard Reade, C.E., F.G.S.—Ripple-marks in drift, by T. Mellard Reade, C.E., F.G.S.

CAMBRIDGE

Philosophical Society, February 25.—The following were elected Fellows of the Society :—Mr. A. R. Forsyth, B.A., Trinity College, Mr. W. J. Ibbetson, B.A., Clare College.—The following communications were made to the Society :—On the sums of the divisors of a number, by Mr. J. W. L. Glaisher. —On primitive roots of prime numbers and their residues, by Mr. A. R. Forsyth.—A comparison of Maxwell's equations of the electro-magnetic field with those of Helmholtz and Lorentz, by Mr. R. T. Glazebrook. The author pointed out that the main difference between the two theories turned on the fact that while Maxwell considers the electric displacement throughout the field, Helmholtz deals with the electric moment of each element of volume supposing that by the action of the inducing force opposite electricities are driven to opposite ends of each element. Maxwell's displacement corresponds to the induction in the magnetic field, Helmholtz's polarisation to the induced magnetisation. The existence of a normal wave was discussed, and it was shown that Maxwell's equations without the solenoidal condition $\frac{df}{dx} + \frac{dg}{dy} + \frac{dh}{dz} = 0$, lead to the same result as those of Helmholtz, at any rate in the case in which a plane wave is traversing the medium. It was further pointed out that in the case in which the induction is due to the presence of electricity at rest outside the portion of the field considered, the above solenoidal condition must hold.

EDINBURGH

Royal Society, February 4.—The Right Hon. Lord Moncreiff, president, in the chair.—The President gave a review of the hundred years' history of the Society, a full report of which appeared in our issue of February 14 (p. 368).—The Abbé Renard and Mr. John Murray communicated notes on the microscopical characters, the chemical composition, and distribution of volcanic and cosmic dust; and also a paper on the nomenclature, origin, and distribution of deep-sea deposits. Dust obtained by melting snow from Ben Nevis was not volcanic in character. —The Abbé Renard gave a note on a large crystal of calc-spar found by Prof. Tait in Lough Corrib.

DUBLIN

Royal Society, January 21.—Physical and Experimental Science Section.—G. F. Fitzgerald, F.R.S., in the chair.—Prof. W. N. Hartley, F.R.S.E., read a paper on a simple method of observing faint lines with diffraction spectroscopes. The author states that he works in a darkened room, the goniometer of the spectroscope being illuminated by a shaded lamp which stands to right of the telescope. The grating is movable, while the collimator and telescope are fixed in such a position as to include as small an angle between them as possible. The telescope being to the right of the collimator, a small gas jet is placed upon the left, the rays of which proceed to the grating and are reflected into the field of the telescope. By the adjustment of this light the field may be illuminated in any colour of the spectrum, and by selecting that tint which is complementary to the colour of the lines to be measured, they are sure to stand out apparently in relief on a bright ground.—Howard Grubb, M.E., F.R.S., read a paper on a new form of equatorial telescope. The author referred to an instrument of his construction which has been at work in Cork Observatory for the last two years, in which the eyepiece is placed in a fixed position in the interior of a building. The success of this instrument induced the author to attempt to carry out the same principle on a larger scale, the difficulty to be overcome being that of producing a perfect plane of sufficient size. The author described a form of instrument which, by a combination of a dialytic telescope and his siderostatic form of mounting, would admit of its being of the largest dimensions without the necessity for employing very large reflectors, as in the case of the new French instrument described in NATURE, November 8, 1883 (p. 36). Mr. Grubb claimed that the form of instrument now described possesses all the chief advantages of the French form, while the difficulties of manufacture would be one-ninth, and the cost about the same as the ordinary construction, including dome. Another important advantage claimed is that the difficulty of construction is not increased in the same proportion as in the French form, and therefore Mr. Grubb's arrangement would be applicable to instruments of the largest size.—Greenwood Pim, F.L.S., communicated a paper on the rendering by photography of light and dark colours in their natural values, in the course of which he pointed out that while the ordinary bromide gelatine plates at present so extensively employed rendered a blue of low illuminating power almost white and a yellow of high illumination very dark, by using the isochromatic plates patented by Messrs. Attout-Tailfer and John Clayton of Paris these colours were reproduced in shades corresponding to the illuminating power. Numerous prints from ordinary and from isochromatic plates of ribbons, coloured fabrics, coloured drawings of flowers, &c., were exhibited, clearly showing the superiority of the latter plates when blue and yellow colours had to be photographed ; thus avoiding over-exposing the blue in order to bring out the detail of the yellow portion. These isochromatic plates are prepared with eosine in presence of an alkali, usually ammonia, and appear to owe their property more to the chemical action than to the physical action of its red colour ; for a screen of eosined collodion interposed between a band of coloured ribbons and the sensitive plate, so as to cover part and leave part uncovered, had but little effect, all that could be noticed being a general slowing action, and not more in the blue than in the yellow.

Natural Science Section.—Rev. Maxwell Close, M.A., in the chair.—Rev. S. Haughton, F.R.S., read a paper entitled "Remarks on the unusual sunrises and sunsets that characterised the close of the year 1883." The older writers on astronomy, such as Brinkley and Maddy, state that on the average twilight lasts until the sun is 18° below the horizon. From this it has been computed that the height of the twilight-producing atmosphere is—

40	miles on hypothesis of	one	reflection,
12	,,	,,	two reflections,
5	,,	,,	three ,,
3	,,	,,	four ,,

Herschel and Newcomb make no statement whatever as to the duration of twilight. Chambers (in his compilation) says that the average depression of the sun is 18°, which is reduced to 16° or 17° in the tropics, but in England a depression ranging from 17° to 21° is required to put an end to the twilight phenomena. Dr. Ball informs me that Prof. Schmidt, of Athens, gives for that place 15° 51′, and also that Liais (Paris) fixes the first twilight arc to set at 10° 41′, and the second at 18° 18′. In the following observations I calculate the zenith distance of the sun at the close of the phenomena by the well-known formula—

$$\cos z = \alpha + \beta \cos h,$$

where

z = sun's zenith distance,
h = sun's hour angle,
$\alpha = \sin \lambda \sin \delta$,
$\beta = \cos \lambda \cos \delta$,
λ = latitude of place of observation,
δ = declination of sun.

Observation I.—Mr. Bishop, observing at Honolulu, found the phenomenal sunsets to commence on September 5, 1883, and to last up to 7.25 p.m.

Here $\lambda = 22°$,
$\delta = 6° 16'$.

This gives the sun's place 18° 22′ below the horizon. This indicates twilight phenomena intensified by some unusual cause, but does not denote an extension of twilight reflection into regions of the air higher than the time-honoured traditional 40 miles. The epoch of the main eruption of Krakatoa has been fixed by Gen. Strachey at August 27 9.32 a.m. If the explosion of Krakatoa on August 27 was the cause of the brilliant sunset at Honolulu on September 5, the result is nothing short of miracu-

lous! The Editor of NATURE writes on December 20 (p. 174), with an enthusiastic glow worthy of the twilights: "The extraordinary fact now comes out that before even the lower currents had time to carry the volcanic products to a region so near the eruption as India, an upper current from the east had taken them in a straight line *viâ* the Seychelles, Cape Coast Castle, Trinidad, and Panama, to Honolulu, in fact very nearly back again to the Straits of Sunda!" [The note of admiration is not mine]. It is worth our while to calculate the rate at which this wonderful journey of volcanic dust was performed. The actual distance is 255° of a great circle, and the time of journey nine days, from which I calculate the speed of the train to have been eighty-two miles per hour! This is absolutely incredible, and becomes still more so when we know that the phenomena observed at Honolulu were unusual twilight phenomena, but had no connection whatever with reflection from the upper regions of the air. In point of fact, my calculation of the sun's position disproves the presence of dust or any reflecting substance in the upper air. Observation II. Dunsink Observatory (a letter received from Dr. R. S. Ball, F.R.S., January 7, 1884):—"Sunday evening, December 30, was exceptionally fine, and the sunset was so well seen, that the moon, though only twenty-seven hours old, was well seen by Cathcart and myself from the roof of the Observatory. We estimated that the twilight lasted certainly for two hours after sunset, and that for ten minutes longer there was still enough light in the western sky to distinguish it from other parts of the horizon. At two hours the sun's zenith distance is 15° 56′; at two hours and ten minutes it is 16° 51′. The first figure coincides almost exactly with the 15° 51′ given by that most skilful observer Schmidt (*vide Astron. Nach*, No. 1495), of Athens, as the zenith distance at the end of astronomical twilight. The 18° which the text-books state to be the limit, seems to be a survival from Kepler, who had it from Ptolemy. There seems to be rather a dearth of careful observations on the subject, at least I can find but few good references to it in Houzeau's *Astronomy*. The only one of this century there contained besides Schmidt is Liais' (*Comptes Rendus*, t. xlviii. p. 110); he says that the first 'arc crépusculaire' sets at 11° 42′, and the second at 18° 18′. It appears to me that on the whole the truth lies nearer to 16° than to any other figure." Observation III. (a letter received from Mr. R. S. Graves, Kingstown, Co. Dublin, December 26, 1883):—"I was on Kingstown Pier yesterday evening (25th inst.), and as the after-glow of sunset looked so beautiful behind the hill, I lingered on the pier, looking at the wonderful brightness and beauty of the whole west sky. The red glow continued to throw *distinct* light on the harbour's shipping till 5.20; from that time, however, the light faded very fast, and at 5.30 it was black night, although the sky was still very red. After this hour the light-giving power seemed to have gone. I see the sun set at 3.53 p.m. (Dublin almanac). The lights in Kingstown presented a very curious appearance: looking at the bright red above the hill, then the hill, and under the hill the hundreds of lights looked just like one of those fancy foreign pictures with pinholes stuck in everywhere to represent the lights. I wish you could have seen the whole scene." N.B. The sun was 14° 15 below horizon at close of phenomena. Observation IV. (a letter received from a correspondent in Old Derrig, Co. Carlow, December 31, 1883):—". . . I have, of course seen a good deal of the after-glow. Some evenings the appearance is like the glare of limelight at a theatre, the effect on grass or garden very strange. With back to west each blade of grass is like fire, a bit of straw like a red-hot needle; but facing the light, it is all lurid light and shade. Last night sun set by almanac at 3.47; here the sun disappears twenty and twenty-five minutes before, owing to hills. At 4.30 the glow was splendid; at 5.10 I could see seconds-hand of watch 23 minutes after sunset, or nearly 1¾ hour after sun had vanished from us. A planet from 4.30 to 5.10 was in the glow, and from 5 and 5.30 was bright emerald green." N.B. The sun was 15° 15′ below horizon at close of phenomena.—Prof. W. R. McNab, M.D., read a paper entitled: "Note on the botanical topographical divisions of Ireland." The districts adopted by the authors of the "Cybele Hibernica" not being readily comparable with the divisions into provinces, vice-provinces, and vice-counties, as defined by Watson, it is proposed to treat the "districts" as equivalent to provinces, and to arrange thirty-six vice-counties under the twelve provinces. The divisions Dr. McNab thus proposes to adopt in the "Cybele Hibernica" collection at Glasnevin, Dublin, are the following:—Province I. West Munster.—Vice-counties: 1. Kerry. 2. S. Cork. II. East Munster.—(3) N. Cork; (4) Waterford; (5) S. Tipperary. III. West Leinster.—(6) Kilkenny; (7) Carlow; (8) Queen's County. IV. East Leinster.—(9) Waterford; (10) Wicklow. V. North Leinster.—(11) Kildare; (12) Dublin; (13) Meath; (14) Louth. VI. West Shannon.—(15) Limerick; (16) Clare; (17) East Galway. VII. East Shannon.—(18) North Tipperary; (19) King's County; (20) Westmeath; (21) Longford. VIII. West Connaught.—(22) West Galway; (23) West Mayo. IX. East Connaught.—(24) East Mayo; (25) Sligo; (26) Leitrim; (27) Roscommon. X. South Ulster.—(28) Fermanagh; (29) Cavan; (30) Monaghan; (31) Tyrone; (32) Armagh. XI. West Ulster.—(33) Donegal, and City of Londonderry. XII. East Ulster.—(34) Down; (35) Antrim; (36) Derry.—Prof. A. C. Haddon communicated a paper on an apparatus for demonstrating systems of classification, &c.—The apparatus, which was exhibited last March, consists of a series of glass plates placed horizontally one over the other, leaving a small space between each plate. On these plates oblong blocks of wood rest on which are printed the names of the forms whose affinities it is desired to indicate, thus constituting a classification in *three dimensions of space*. This apparatus is especially useful in palæontology.

PARIS

Academy of Sciences, March 3.—M. Rolland in the chair.—Researches on explosive gaseous mixtures, by MM. Berthelot and Vieille. The results are here tabulated of 250 experiments made with forty-two distinct explosive compounds, including not only mixtures of oxygen and hydrogen, the oxide of carbon and formene, pure or mixed with nitrogen, but also mixtures including cyanogen, acetylene, ethylene, methyl, methylic ether, and common vapour of ether. Studies were also made of mixtures of oxygen with two combustible gases together, such as the oxide of carbon and hydrogen, as well as combinations of the protoxide of nitrogen mixed with hydrogen, with the oxide of carbon, with cyanogen, and the bioxide of nitrogen mixed with cyanogen. The main object of the experiments was to determine the amount of pressure developed at the moment of explosion, the temperature produced, and the specific heats of the gases at various temperatures, and especially those of the compound gases.—On a recent note of M. D. André, by Prof. Sylvester. It is shown that M. André's theorem is a direct consequence of the generalisation given by the author to Newton's theorem ("Universal Arithmetic," part 2, chap. ii.) on the imaginary roots of equations.—Remarks on the maps of Madagascar from the Middle Ages to the present time, by M. Alf. Grandidier. The author, who identifies Ptolemy's Menuthias with Madagascar, shows that this island was known to the Greek and Arab geographers long before its rediscovery by the Portuguese in 1500 (not in 1506 as is usually supposed).—On the principle of separate watertight compartments in ship-building, and on the first men-of-war constructed on this principle, by M. Bertin.—New experiments showing how Nobili's electro-chemical rings may be imitated by means of a continuous stream of water falling from a cylindrical tube vertically on a horizontal sheet of black glass moistened all over, by M. C. Decharme.—Description of a new process of generating steam, by M. Bordone.—Theorem by means of which it may be ascertained that certain algebraic equations have no positive root, by M. Désiré André.—Note on hyperfuchsian functions, by M. E. Picard.—On the groups of finite order contained in the group of undeterminative and reversible substitutions of the second order, that is, the quadratic substitutions of Cremona, by M. Autonne.—On linear equations of the second order with partial differences, by M. R. Liouville.—Note on the oxychloride of barium, by M. G. André.—On a new group of nitrous compounds, by M. R. Engel.—On the oxidation of menthol by means of the permanganate of potassium, by M. G. Arth.—On two campholurethanes with an isomerous relation analogous to that presented by M. Pasteur's right and left tartaric acids, by M. Haller.—Experiments on the toxic or medicinal substances which modify hæmoglobin, and especially on those that convert it into methæmoglobin, by M. G. Hayem.—On the conditions favourable to the development of root-suckers in plants, by M. E. Mer.—Analysis of the mineral substances friedelite, discovered by M. Bertrand, and pyrosmalite, found at Dannemora in Sweden, by M. Alex. Gorgeu.—Note on the existence of manganese in a state of complete diffusion in the blue marbles of Carrara, Paros, and the Pyrenees, by M. Dieulafait.—On the coincidence of the transformations observed in the Pons-Brooks comet with its passage across currents of a cosmic character, by M. Chapel.—Notice of two Chinese works

on elementary and analytical chemistry presented to the Academy by M. Billequin of the Imperial College, Pekin.

BERLIN

Physical Society, February 8.—Prof. Lampe referred to two recent works on mechanics, one by Herr Streintz, the other by Herr Mach, and brought forward certain problems, which were there dealt with at full length.—Prof. Schwalbe described a peculiar ice-formation he had observed in the Harz towards the end of December last. Under a temperature of from + 2° to + 3° C. by day and − 1° to − 2° C. by night, he perceived, on a road covered with gravel and withered leaves, swellings of the surface at various spots, which, on closer inspection, proved to be ice-protuberances rising from the ground and pushing up its topmost stratum. On the unfrozen earth stood separate, diminutive ice-columns of from three to four centimetres in height, each supporting at its upper extremity a little stone or a withered leaf which it had loosened from the ground and in the course of growth had lifted upwards. Similar swellings were found by Prof. Schwalbe on rotten twigs lying on the ground. In these the rind over a large surface was pushed from the wood by ice-excrescences of soft, brilliant, asbestine appearance, and uncommonly delicate to the touch. They adhered in large numbers to the body of the wood, and reached as great a length as one decimetre. Prof. Schwalbe brought some of these withered and rotten twigs with him to Berlin, and it was in his power to produce on them at any time the phenomenon just described. For this purpose all that was needed was thoroughly to moisten the twig, in such a manner, however, that no water dropped off, and then to let it cool slowly in a cold preparation. Ice-excrescences also appeared of themselves on twigs lying in the garden whenever the temperature fell below 0° C. in the night. In reference to the explanation of this phenomenon, Prof. Schwalbe favoured the view of Le Conte, who had described the matter thirty years ago, and considered it as an instance of capillary action. In the process of slow cooling, the water in the pores became frozen into a small capillary tube, which sucked the water up, and this in turn becoming congealed shot continually further upwards. In this way the little stone or the withered leaf lying on the road, or the rind on the rotten twig, was pushed constantly further away from the substratum, and lifted upwards.

Physiological Society, February 15.—In continuation of the address delivered by him at the last sitting of the Society, Dr. J. Munk set forth the further course of his investigations into the resorption, formation, and deposition of fats in the animal body. After, by feeding a dog on rape-seed oil, he had demonstrated that heterogeneous fats were absorbed and deposited in the animal body, he passed to the question in what manner was the resorption effected. It was universally assumed that the fats in the intestinal canal were emulged, and, as emulsion, entered through the intestinal villi into the chyle vessels. In order to the production of an emulsion it was now first of all necessary that the fat should become fluid at the temperature of the body; and second, that the intestinal contents should be alkaline. As was, however, well known, there were fats which did not melt unless at a temperature of over 40° to 50° C., that is, they could not become fluid at the temperature of the body—mutton suet, for example, which was therefore incapable of being emulged in the intestinal canal. Still less so were the sebacic acids of mutton, which could be only melted at higher temperatures. It had therefore to be experimentally proved whether such fats generally were resorbed. Dr. Munk had a year ago briefly related to the Society an experiment directed to this end, in which he fed a dog with mutton suet. It had yielded a positive result. The fat taken from the body of the dog which had been fed on mutton suet was essentially distinct from the normal fat of a dog, both by its whiter colour and by its greater consistence. On chemical examination, too, it was confirmed that the dog had deposited mutton suet in its body. The experiments now in question, which the speaker described at greater length, were of such a kind that a dog was brought to a state of equilibrium in respect to nitrogen, that is, to such a state that just as much nitrogen was secreted from the body as was supplied it with the food. At certain epochs along with the albumen, either lard or mutton suet, or the sebacic acids of mutton, were administered for a number of days, and during that time careful analyses were made of the evacuations. By these analyses, besides the above-mentioned fact of the deposition of mutton suet in the canine body, it was established that the lard was almost completely used up, only 2 per cent. having been lost to the body in the evacuations, while of the mutton suet about 94 per cent. was absorbed in the intestinal canal, and even of the sebacic acids of mutton 86 to 87 per cent. was taken up. In the last case the quantity of nitrogen secreted was somewhat greater than the quantity received, so that a part of the alimentary albumen was decomposed. Mutton suet, or the sebacic acids of mutton, might therefore be used for feeding; in the excrements a larger quantity of free sebacic acids and of soaps along with neutral fat was always found, a fact which indicated a splitting of the neutral alimentary fats in the intestine. The existence of such a splitting of the neutral fats was also confirmed by the demonstration that the contents of the small intestine never showed alkaline reaction, but reacted either in an acid or neutral manner. This could not be referred to any extensive transition of the contents of the stomach, for the small intestine was found to be always very lax and almost empty, if an excitement of stronger peristaltic movements were carefully avoided during the experiments. A process of emulsion on the part of the mutton suet, which from its consistence offered great difficulties, must therefore, even on account of the reaction of the intestinal contents, be excluded from the problem, and Dr. Munk was of opinion that the demonstrated splitting of the fats must play a very important part in the absorption, the nature and manner of which would have to be studied by further investigations. Lately, microscopical demonstrations had been given by other observers that lymphatic corpuscles strayed towards the free intestinal surface, and there supplied themselves with alimentary substances, laden with which they again strayed back. Such a mechanical absorption was, in Dr. Munk's opinion, highly probable in cases in which the fat was not liquefied by the temperature of the body, as, for example, in the case of feeding on mutton suet.—Dr. Benda described microscopic preparations which he made from tuberculous kidneys, and which he exhibited to the members of the Society for their inspection.

CHRISTIANIA

Society of Science, February 1.—Dr. Collet described the *Beryx borealis*, a remarkable deep-sea fish, and the northern representative of the genus *Berycidæ*, so common in the Chalk period, and its relation to *Beryx decadactylus* of Madeira and Japan.—Prof. Lochmann mentioned a case of poisoning by gas, and referred to the influence of subterranean air on the human organism.—Prof. Lie presented a paper on the common theory of differential equations.—Dr. Kjær described two species of moss, *Hylocomium squarrosum* and *Climacium dendroides*, which were discovered in the clay in the hill in which the famous Norse Viking ship was found near Sandefjord in 1880.

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